



The  
Patent  
Office

09/889478

ACT/GB 00/00109



INVESTOR IN PEOPLE

GRU  
00109

The Patent Office  
Concept House  
Cardiff Road  
Newport

South Wales  
NP10 8QQ

|       |             |
|-------|-------------|
| REC'D | 09 FEB 2000 |
| WIPO  | PCT         |

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed

*[Signature]*

Dated

1 FEB 2000

**PRIORITY  
DOCUMENT**

SUBMITTED OR TRANSMITTED IN  
COMPLIANCE WITH RULE 17.1(a) OR (b)



# Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)



The Patent Office

Cardiff Road  
Newport  
Gwent NP9 1RH

1. Your reference

PA 3431

2. Patent application number

(The Patent Office will fill in this part)

03 SEP 1999

9920922.3

3. Full name, address and postcode of the or of each applicant (underline all surnames)

QDOS MEDIA LIMITED,

QDos House

2 Ashley Way

West End

Woking

Surrey GU24 9NJ

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

UK

7506728000

4. Title of the invention

IMPROVED SMART CARD

5. Name of your agent (if you have one)

SOMMERVILLE & RUSHTON

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

45 Grosvenor Road

St Albans

Herts

AL1 3AW

Patents ADP number (if you know it)

1511001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number

Date of filing

(if you know it)

(day / month / year)

GB

9819108.3

3 September 1998

GB

9900891.4

16 January 1999

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing

(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

a) any applicant named in part 3 is not an inventor, or

b) there is an inventor who is not named as an applicant, or

c) any named applicant is a corporate body.

See note (d))

Yes

# Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form

Description

15 ✓

Claim(s)

3 ✓ *281*

Abstract

1 ✓

Drawing(s)

5 *+5*

10. If you are also filing any of the following, state how many against each item.

Priority documents

0

Translations of priority documents

0

Statement of inventorship and right to grant of a patent (*Patents Form 7/77*)

1 ✓

Request for preliminary examination and search (*Patents Form 9/77*)

1 ✓

Request for substantive examination (*Patents Form 10/77*)

0

Any other documents  
(please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature *Sammariller Rington* Date 3 September 1999

12. Name and daytime telephone number of person to contact in the United Kingdom

Dr Rachel Christophers  
01727 854215

## Warning

*After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.*

## Notes

- If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.*
- Write your answers in capital letters using black ink or you may type them.*
- If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.*
- If you have answered 'Yes' Patents Form 7/77 will need to be filed.*
- Once you have filled in the form you must remember to sign and date it.*
- For details of the fee and ways to pay please contact the Patent Office.*

## **IMPROVED SMART CARD**

### 5 **Field of the Invention**

The invention relates to an improved smart card and in particular, but not limited to, a smart card with a parallel data interface. The invention also relates to a reader/writer for reading or writing information to such a smart card and to an electronic book for use with such an improved smart card.

10

### **Background of the invention**

Conventional smart cards, such as those conforming to International Standard ISO 7816, are used for secure data storage but are limited in the amount of data that can be stored on the smart card. In order to conform with the ISO standard, integrated circuits within a smart card should be located under contact areas on the surface of the smart card. Also, the interface of conventional smart cards, such as those conforming to the ISO standard, are limited with respect to the speed with which information can be read from that smart card.

In the international standard and conventions agreed for Smart Card protocols, in particular ISO7816 parts 1-6, a serial data interface as defined in the ISO7816 standard is used for accessing data from integrated circuits on the smart card. This arrangement is only satisfactory for the limited amount of data transfer necessary to carry out the security code functions and limited data transfers in conventional Smart Card applications. For example, library access cards, telephone cards and identification cards. Also, when data is accessed from a conventional smart card using the ISO7816 standard, the control data for operation of the smart card protocol must also be communicated between the smart card and a smart card reader. This means that not only is the data transfer rate limited by the interface

design but also the actual data transfer rate (not including control data) is limited by the need for the control data.

For example, smart cards have been tested for use in biometric systems in which individuals are issued with a smart card containing personal information about that individual. For example, medical records, fingerprint records and other personal details. However, the use of smart cards for this purpose has been unsuccessful to date, because the storage capacity of the smart cards has been too small.

The present invention also relates to electronic books for use with smart cards and some background information about electronic books is now given.

Electronic books comprising a memory for storing text and graphical information and a display screen for displaying this information are known, for example as described in WO/9722065. This document discloses a portable, hand-held reading device which incorporates a removable machine-readable storage medium such as a smart card or PCMCIA card (also known as a PC card). However, one problem with PCMCIA cards is that they are relatively expensive to manufacture, especially in the case that single-use applications are required. For example, where a book is recorded on a PCMCIA card and that PCMCIA card is not intended to be erased and used again to store a different book at a later time.

Smart cards are less expensive to produce than PCMCIA cards and are simpler and often less bulky. However, conventional smart cards do not contain enough memory to store a typical book. For example, a book may take up 4 Mb of memory whilst a conventional smart card only contains between about 256 bytes to 8 k bytes of data storage capacity. Another problem is that conventional smart card readers (such as those designed to conform to the smart card interface standard ISO 7816) are limited with respect to the speed in which data from the smart card can be read. That is, even if a smart card were able to store a whole book, it would not be possible to read this information quickly enough from the smart card using a conventional smart card reader.

Other types of electronic book, such as that described in US 5475399, use CD ROMs or floppy disks to store the book contents. However, the reader mechanisms contained in the electronic book must then incorporate moving parts which are prone to damage, especially in a portable display device. CD ROM  
5 readers and hologram readers (for example, US 4159417 describes an electronic book which uses a hologram storage mechanism) involve light sources or lasers and these are also difficult to maintain and operate in a portable display device like an electronic book.

Another option is to use an electronic book which contains its own memory  
10 and where information for the book contents is downloaded from a Personal Computer (PC) or the Internet (for example, see US 5761485). However, this has the disadvantage that the user needs to be able to operate the PC or know how to obtain information from the Internet. Also, downloading information in this way is time consuming and prone to problems, for example, if the internet connection is lost  
15 during the download process.

It is accordingly an object of the present invention to provide a smart card which overcomes or at least mitigates one or more of the problems noted above.

### **Summary of the Invention**

20 According to a first aspect of the present invention there is provided a smart card comprising:

- (I) A sheet of supporting material;
- (II) An electrical contact means provided on said sheet of supporting material and adapted to provide an electrical contact with a smart card  
25 reader in use;
- (III) one or more integrated circuits supported by said sheet; and

(IV) interface means comprising a serial data interface and at least one parallel data interface arranged such that in use, data stored in said integrated circuits may be accessed via said parallel data interface.

This provides the advantage that data transfer from the smart card is increased relative to a conventional smart card, by virtue of the parallel data interface. Also, because a serial data interface is also provided, the smart card can still be used with a conventional smart card reader, although not making use of the parallel data interface. Once the data transfer rate is increased in this way it is possible to incorporate more memory capacity into the smart card whilst still being able to access data stored in this extra memory in a practical time. The resulting smart card provides a cost-effective solution for efficient, secure storage and retrieval of relatively large amounts of data (as compared with a conventional smart card) on a conveniently sized, portable medium.

Preferably said integrated circuits are positioned below said contact means. This allows the improved smart card to conform with the ISO 7816 requirement that the integrated circuits be positioned below the contact pads.

According to another aspect of the present invention there is provided a smart card reader suitable for reading data from a smart card comprising a serial and a parallel data interface, said smart card reader comprising:

- (i) An electrical contact means adapted to provide an electrical contact with said smart card in use; and
- (ii) interface means adapted to accept data from said serial data interface and said parallel data interface in use.

This provides the advantage that data from a smart card can be accessed at relatively high rates using the parallel data interface, as compared with a conventional serial data interface for an ISO 7816 smart card reader.

The invention also encompasses an electronic book containing such a smart card reader and an electronic book comprising a removable smart card storage

means wherein the smart card is as described above. The invention further encompasses a portable hand-held audio player comprising a smart card reader where the smart card reader is as described above.

5 **Brief description of the drawings**

Figure 1 is a plan view of an improved smart card.

Figure 2 is a general schematic diagram indicating the electrical connections of an improved smart card interface.

Figure 3a is a plan view of an improved smart card which has two interfaces.

10 Figure 3b is a side view of the improved smart card of figure 3a.

Figure 4 is a schematic diagram of an improved smart card interface.

Figure 5 is a schematic diagram of an improved smart card interface with octagonal ground planes.

15 Figure 6 is a schematic diagram of an improved smart card interface with circular ground planes.

Figure 7 is a perspective view of an electronic book for use with an improved smart card.

Figure 8 is a schematic illustration of the functional blocks of electronics comprised with the electronic book of Figure 7.

20

**Detailed description of the invention**

Embodiments of the present invention are described below by way of example only. These examples represent the best ways of putting the invention into practice that are currently known to the Applicant although they are not the only ways  
25 in which this could be achieved.

Figure 1 is a plan view of an improved smart card 101 which comprises a sheet of supporting material 102 such as a thermoplastics card within which integrated circuits are embedded (not shown). The improved smart card 101 has a

contact means 103 which comprises two contact areas or pads 104, 105. These contact areas also represent the interface means. In a preferred embodiment the integrated circuits are located only under the contact areas or pads. By including two contact areas or pads 104, 105 the available area under which integrated circuits can be located is increased. Additional integrated circuits are provided as compared with an ISO 7816 smart card, in order to increase the memory capacity available.

One of the contact areas 104 comprises a serial data interface such as those conforming to the ISO 7816 standard. The other contact area 105 comprises a parallel data interface as described below. It is also possible to use more than one parallel data interface by positioning extra parallel data interfaces on the support surface 102 around serial data interface 104.

Figure 2 shows example electrical connections within each contact area 104, 105 in more detail. Each contact area 104, 105 comprises a ground connection a, b, and these are connected to one another. For this reason it is advantageous to position the contact areas 104, 105 next to one another, but this is not essential.

Figure 3a is a plan view of a smart card which has one interface means 301 positioned at one end of the support sheet and another interface means 302 positioned at the other end of the support sheet. Also, the interface means 301, 302 are on opposite sides of the support sheet as shown in Figure 3b.

The improved smart card described herein augments the 'Smart' interface as in ISO 7816. The improved smart card enables parallel data transfers between a Credit Card sized (86mm x 54mm) standard card and a host reader. This increases data transfer through the interface by at least eight times the speed of existing serial interfaces (such as those conforming to ISO 7816 standard), for the same clock speed at the interface.

The improved smart card gives a sampling rate at one byte instead of the conventional one bit per clock serial data transfers of smart cards conforming to ISO 7816 standard. This enables the improved Smart Card to carry out more complex

assignments and broadens the generic use of the improved smart card as an information source.

In one embodiment, the improved smart card also contains increased storage capacity as compared with the 256 bytes to 8k bytes (typical) of data storage capacity normally available in a Smart Card. This enables the improved smart card to act as a replacement for text books, catalogues containing pictures, audio tapes, CD ROMs, PCMCIA memory cards, floppy disks, camera cards and other optical, magnetic, and electronic media for data storage.

When the storage capacity within the improved smart card is increased it is particularly advantageous to reduce data transfer times between the Smart Card and host reader. This is achieved using a parallel interface which enables a faster data transfer rate to be accomplished using the existing serial clock rate. If required, a higher clock rate can also be used which further increases the data transfer rate. In this case, the ISO 7816 protocol clock speeds may not be met, but this is acceptable for non ISO applications.

In one example, the improved smart card has similar external dimensions as a conventional Smart Card and utilizes the contact pad protocols of the ISO 7816 standard to position the serial port interface. In addition an adjacent interconnected contact pad is provided to allow transmission of parallel information.

In one example, the serial data interface consists of an ISO 7816 eight pin interface and the parallel data interface comprises a further eight pin interface. The resulting interface means consists of sixteen pins in total, and occupies an area of double the width of the normal ISO 7816 interface.

A ground connection at pin 5 (see Figure 2) of the serial data interface is extended across via the centre of the serial data interface contact area 104 to the centre of the parallel data interface contact area 105. Detection of a ground connection at the centre of the parallel data interface contact are 105 distinguishes

the improved smart card, from a normal ISO 7816 interface. This does not affect the integrity of the ISO 7816 interface connections.

The new eight pins (9 to 16 in Figure 2) comprising the parallel data interface are connected to the data bus of memory circuits (integrated circuits) internal to the Smart Card. Thus, once data transfer has been initiated, the data can be transferred one byte (eight bits) at a time compared to the one bit at a time over the serial connection at pin 7 (see figure 2) of the normal ISO 7816 interface. The data transfer in both cases is synchronous with the data clock, which is present at pin 3 (see figure 2) of the normal ISO 7816 interface.

As the actual data accessed from the smart card data is embedded within the serial data protocols of the ISO 7816 standard, the true user-data transfer rate is considerably slower than the possible serial clock rate. Once data transfer has been initiated, the interface means 103 transfers data at eight times the serial clock rate. Thus user-data transfer is at a much greater rate than the normal ISO 7816 standard allows, and the integrity of the ISO 7816 standard is not compromised.

The existing ISO 7816 standard pin numberings and functions of the normal interface are retained in the serial data interface. The additional pins of the parallel data interface are numbered 9 through to 16, and correspond to data bits 1 through to 8 of the data bus connections (i.e. an eight-bit wide data bus). The new pins of the parallel data interface are numbered in the same fashion as the pins 1 through to 8 of the serial data interface. Thus pin 9 of the Second Part is adjacent to pin 4 of the First Part, and pin 13 of the Second Part is adjacent to pin 8 of the First Part. (See Figure 2).

The serial data interface can be arranged to provide a means of authentication. That is, on use of the improved smart card, a smart card reader first communicates with the smart card via the serial data interface and checks security details stored in that smart card (for example a personal identification number). Then, once authentication is successfully completed, data on the smart card can be

accessed via the parallel data interface. Similarly, new data can be written to the smart card via the parallel data interface.

Figure 1 shows the position and proportions of the interface means 103 relative to the Smart Card 101. The position of the serial data interface, for example an ISO7816 standard interface 104 is shown in Figure 1. Adjacent to this, and maintaining the same contact separation as the contacts of the serial data interface 104, is the parallel interface 105. This comprises a further eight contacts, the minimum contact pad proportions and dimensions of which conform to the detail dimensions of the contact pin connections of ISO7816, but are positioned adjacent to the existing interface serial interface 104. The serial and parallel data interfaces 104, 105 comprise the interface means 103.

Figure 2 shows the electrical connections of the interface means 103. Pins 1 to 8 conform to the ISO7816 standard and have the same numbering and pin functions. Pins 9 to 16 correspond to the parallel data bits one to eight respectively. The existing 'ground' contact at pin 5 of the serial data interface 104 is extended through the physical centre of the serial data interface 104 - see figure 2, Pin 'a', to the physical centre of the parallel data interface - see figure 2, Pin 'b'. The contact pad areas 'a' and 'b' represent the minimum areas which must be available as 'ground' connections to the centres of interfaces 104, 105. Thus pin 5 of the existing ISO7816 interface is electrically and mechanically connected to pins 'a' and 'b' of interfaces 104 and 105.

The interface reader (not shown) makes an external 'ground' connection at pin 5, as in a conventional Smart Card reader. Detection of a 'ground' at pin 'a' only indicates a conventional Smart Card has been inserted into the reader. Detection of a 'ground' at pins 'a' and 'b' indicates a 'Parallel Interface' Card has been inserted.

The smart card 101, conventionally is a flat planar rectangular surface, of nominal thickness 0.3mm to 1.00mm. In current usage the ISO standard requires the longitudinal axis to be inserted into a reader port. The electrical apparatus as

described herein is not restricted to the convention and may be inserted into an appropriately engineered transverse axis port.

Figure 3 shows various positions that interface means 103 may be located on the smart card 101. It is possible to position an interface means 103 at either or both ends of the card and on one or both sides or faces of the card. It is possible, with two opposing read heads, to read both sides of a card at the same time, or contiguously. The preferred positions are with one interface means 103 at each end of the card, on opposing sides. This requires only a single read head. Thus the card is inverted longitudinally to utilize the second interface.

Figures 4, 5, & 6 show different physical implementations of the contact areas of the interface means 103. Figure 4 depicts an interface means 103 constructed in rectangular form, about a central rectangular 'ground' plane. Figure 5 depicts an interface constructed about octagonal centres of the 'ground' planes in the two contact areas 104, 105, using connector pins having angled edges. Figure 6 depicts an interface constructed about circular centres of the 'ground' planes in the two contact areas 104, 105, using connectors having curved edges.

The improved smart card is constructed, for example, by bonding the integrated circuits to the back of the contact pads and epoxy bonding the integrated circuits into a milled out recess in the sheet of supporting material. An alternative method of construction may comprise a flexible PCB with memory and control circuits. Internal dies of integrated circuits are used and are attached direct to the flexible PCB. The whole PCB is then encapsulated between two outer layers of the smart card 717, thus providing protection for the PCB whilst allowing a limited degree of flexibility, as in known uses of smart cards, such as phone cards. Electrical contact pads are provided on the external surface of the smart card. This construction method enables more memory dies to be incorporated within the smart card to increase the memory capacity of the smart card.

It is not essential to use semiconductor devices to provide the memory within the smart card. Alternative types of memory device can be used, such as the recently developed 3D memory storage system which uses metal alloys and gives vast increases in memory capacity for small amounts of storage space. Integrated  
 5 circuits may still be used in conjunction with the 3D memory storage system to control access to that memory system.

Referring now to figures 7 and 8 an electronic book 710 is described which is suitable for use with an improved smart card. The electronic book 710 takes the form of a "smartbook" being intended to be used in a similar fashion to a paperback book,  
 10 that is to enable the user to read a book such as a novel or guidebook.

The electronic book 710 preferably has dimensions similar to those of a paperback book, e.g. 125mm by 200mm by 25mm, and may conveniently be provided in a folding wallet for ease of use. The electronic book 710 comprises a casing 711, and on its front face a display and input screen 712, for example with a diagonal of  
 15 195mm. The casing 711 is preferably formed from one or more plastic moldings. The display and input screen 712 may be of any appropriate kind, for example known liquid crystal kind with backlight, and comprising touch sensitive input means.

The resolution of the display screen 712 is sufficient for the display of text such that it is readily readable by the user. A horizontal resolution in accordance with  
 20 existing VGA standards is appropriate. A vertical resolution of the same standard may be used, alternatively it may be 1 5/8 VGA standard in order to give an aspect ratio of 8 by 13, which corresponds to the layout of most conventional paperback books. This results in a screen resolution of 640 by 1040 pixels.

The touch sensitive input means incorporated in the display and input screen  
 25 712 may comprise however many sensitive points are required to provide "softkeys" for control of the functions provided by the electronic book 710. In one example, no more than 1/16 horizontal and 1/26 vertical sensitive points are required.

The electronic book 710 further comprises, provided within the casing 711, a printed circuit board (PCB) providing the necessary electronic circuitry, in the form of a microprocessor 713, memory 714 and interface means 715 to communicate between the display and input screen 12 and the other parts of the electronic circuitry. In one example, the electronic book 710 uses a relatively slow microprocessor, as the faster the processor the greater the power consumption, and therefore the shorter the battery life, and the greater the heat loss and therefore greater need for cooling perhaps necessitating fans. A microprocessor with a clock frequency of 50 MHz or less, possibly as low as 10 MHz, would be appropriate.

The memory 714 within the electronic book 710 comprises several different memory elements; a screen memory, a main data-storage memory and a main programmable memory. The screen memory will preferably comprise static RAM (Random Access Memory) which retains the data therein so long as a voltage is applied, in order that the last-used-screen is automatically displayed on switch-on. The main data-storage memory is conveniently flash memory in order that it retains the data therein without any requirement for power, hence retaining the memory even if the batteries are changed or they lose their charge. Preferably the main data-storage memory is sufficient for the storage of eight average length books, that is 32 Megabytes. The main programmable memory is conventional PROM (Programmable Read Only Memory) form, and may be socket mounted for ease of replacement or upgrade. Alternatively, the main programmable memory may be flash memory.

The casing 711 comprises a slot 716 for receipt of an improved smart card 717 bearing recorded data, and when in the slot 716 the smart card 717 makes connection with contacts provided on the PCB and hence connection to the interface means 715 for reading of the data stored thereon. The improved smart card 717 is preferably a smart card with a serial and a parallel data interface and an increased

memory as described above. The electronic book comprises a smart card reader which is suitable for reading data from this improved type of smart card.

The casing 711 also comprises a compartment adapted for receipt of one or more batteries as necessary to power the apparatus. Preferably separate batteries  
5 are provided to power the electronic circuitry and the backlight. However, the circuitry will preferably ensure that power is maintained to the screen memory whichever batteries are removed or lose charge, in order to retain a "last-screen-used" function. An on/off switch 718 is also provided.

In one example, the electronic book 710 operates as follows. When a smart  
10 card 717 containing the contents of a book is introduced in to the slot 716 the data is read into one of eight software defined portions of the data-storage memory using a parallel data interface on the smart card 717 and the smart card reader in the electronic book. To minimize the time taken for the book to be available to the user the data is stored on the card in a specific order, which varies depending on the type  
15 of book. For example, for a guide or reference book, first the title page and frontispiece, then the contents page, then the first page of each chapter, and then the remaining portions of each chapter. Thus while downloading of the remaining portions of each chapter from the smart card 717 the apparatus is able to display the contents and first pages to aid selection.

20 Various functions such as being able to enter bookmarks are available to the user. On switch-on the user is offered a number of choices, such as, last page used, bookmarked page, or a set-up page offering other options such as changing book. Options of display font, and font size along with using the screen 712 in portrait or landscape mode may also be provided. Clearly if the selected display mode is such  
25 that the whole page of text is not visible on the screen at one time then the ability to scroll the display horizontally and vertically is available.

If eight books are already stored within the data-storage memory then if another smart card 717 is input into the slot 716 the option of which book to overwrite is available.

The smart cards 717 for use with the electronic book 710 are improved smart cards containing a parallel data interface. They may take one of two forms, either one-time-programmable or re-usable, as is now described.

One-time-programmable smart cards 717 are passive storage devices comprising non-volatile memory and controlled, once inserted into the electronic book 710, by the electronic book 10. They provide a cheap form of data storage with the cost of the smart card itself being a fraction of the selling price of the smart card once programmed. The smart cards 717 may be sold pre-programmed or may be programmed at the point of sale. The latter option enables retailers to stock empty cards and program these on demand thus avoiding much waste, as currently occurs when books are recalled for pulping when sales have been poor. Once programmed the smart cards cannot be overwritten, but can be read a number of times, and as collected form a compact library.

The second form of smart card is the re-usable form. This form has the same physical construction as the one-time programmable form and interfaces with the electronic book 710 in the same way as previously described. In place of non-volatile memory, flash memory, that is dies of re-writable integrated circuits is used.

The re-usable smart card 717 is intended for ephemeral publications rather than for books. For example, for newspapers, magazines or other periodicals. The additional cost of this smart card is offset by its flexibility, as data may be written and rewritten to the same smart card a large number of times. A user of the electronic book 710 could have one or more smart cards and take them to be re-written each day in place of buying a physical newspaper, or each week or month instead of buying a physical magazine. Alternatively, an internet connection may be used to download the data to the smart card.

**Table of Electrical Connections illustrated in Figure 2**

The Electrical connections are: -

Pin 1 - Vcc - typically +5 Volts.

Pin 2 - RST - Reset.

5 Pin 3 - CLK - Data Clock.

Pin 4 - NC - Not Connected - Reserved for future use.

Pin 5 - GND - Ground - 0 Volts.

Pin 6 - Vpp - Programming Voltage.

Pin 7 - I/O - Input / Output.

10 Pin 8 - NC - Not Connected - Reserved for future use.

Pin 9 - Data Bit 1 - Parallel Data - Least Significant Bit - LSB.

Pin 10 - Data Bit 2 - Parallel Data.

Pin 11 - Data Bit 3 - Parallel Data.

Pin 12 - Data Bit 4 - Parallel Data.

15 Pin 13 - Data Bit 5 - Parallel Data.

Pin 14 - Data Bit 6 - Parallel Data.

Pin 15 - Data Bit 7 - Parallel Data.

Pin 16 - Data Bit 8 - Parallel Data - Most Significant Bit - MSB.

Pin 'a' - Ground - Electrically and Mechanically Connected to Pin 5.

20 Pin 'b' - Ground - Electrically and Mechanically Connected to Pin 5.

## Claims

1. A smart card comprising:
  - (i) A sheet of supporting material;
  - (ii) An electrical contact means provided on said sheet of supporting material and adapted to provide an electrical contact with a smart card reader in use;
  - (iii) one or more integrated circuits supported by said sheet; and
  - (iv) interface means comprising a serial data interface and at least one parallel data interface arranged such that in use, data stored in said integrated circuits may be accessed via said parallel data interface.
2. A smart card as claimed in claim 1 wherein said integrated circuits are positioned below said contact means.
3. A smart card as claimed in claim 1 or claim 2 wherein each parallel data interface comprises at least one eight pin interface.
4. A smart card as claimed in any preceding claim wherein said serial data interface comprises an eight pin interface.
5. A smart card as claimed in claim 4 wherein said serial data interface conforms to the ISO 7816 standard.
6. A smart card as claimed in any preceding claim wherein said serial data interface and each of said parallel data interfaces each comprise a ground connection.
7. A smart card as claimed in claim 7 wherein said ground connections are connected together.
8. A smart card as claimed in any preceding claim wherein said integrated circuits comprise a memory bus and wherein each of said parallel data interfaces are connected to said memory bus.

9. A smart card as claimed in any preceding claim wherein said integrated circuits are arranged to provide between 10 Kbytes and 128 Megabytes of data storage capacity.
10. A smart card as claimed in any preceding claim wherein said integrated circuit  
5 has a specified clock speed and wherein each of said parallel data interfaces is arranged to provide sampling rates of one or more bytes per unit of clock speed.
11. A smart card as claimed in any preceding claim wherein said contact means comprises a contact pad, one for said serial data interface and a contact pad  
10 for each of said serial data interfaces.
12. A smart card as claimed in any preceding claim which comprises a plurality of said interface means.
13. A smart card as claimed in claim 12 comprising two interface means, located at different ends and on different sides of the smart card.
- 15 14. A smart card as claimed in any preceding claim wherein said sheet of supporting material is incorporated into a three dimensional structure selected from a cylinder, a sphere, and a cone.
15. A smart card reader suitable for reading data from a smart card comprising a serial and a parallel data interface, said smart card reader comprising:  
20 (i) An electrical contact means adapted to provide an electrical contact with said smart card in use; and  
(ii) interface means adapted to accept data from said serial data interface and said parallel data interface in use.
16. A smart card reader as claimed in claim 15 further comprising detector  
25 means, said detector means being arranged to detect whether a smart card comprises a pair of connected ground connections.

17. A smart card reader as claimed in claim 16 which is arranged such that data is only accepted from said parallel data interface if said detector detects a smart card which comprises a pair of connected ground connections.
18. A smart card reader as in any of claims 15 to 17 which is also suitable for  
5 reading data from a smart card which conforms to ISO 7816.
19. A smart card reader as claimed in any of claims 15 to 18 which is also arranged to write data to said smart card in use.
20. An electronic book comprising visual display means and removable smart card storage means, said smart card storage means comprising a smart card  
10 as claimed in any of claims 1 to 13.
21. An electronic book comprising visual display means and a smart card reader as claimed in any of claims 15 to 19.
22. A portable, hand-held audio player comprising loudspeaker means and a smart card reader as claimed in any of claims 15 to 19.
- 15 23. A smart card substantially as described herein and with reference to any combination of figures 1 to 6.
24. An electronic book substantially as described herein and with reference to any combination of figures 7 and 8.

**Abstract**

A smart card comprising:

- (v) A sheet of supporting material;
- 5 (vi) An electrical contact means provided on said sheet of supporting material and adapted to provide an electrical contact with a smart card reader in use;
- (vii) one or more integrated circuits supported by said sheet; and
- 10 (viii) interface means comprising a serial data interface and at least one parallel data interface arranged such that in use, data stored in said integrated circuits may be accessed via said parallel data interface.

**THIS PAGE BLANK (USPTO)**

1/5

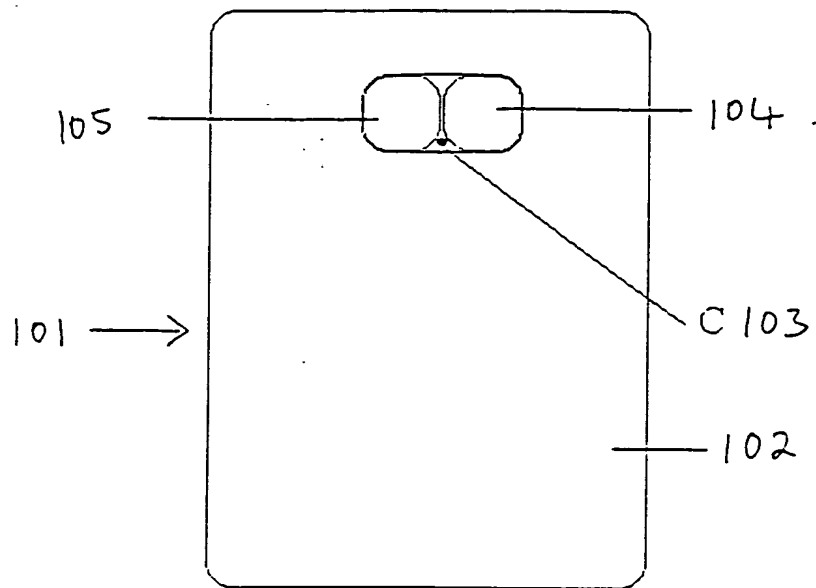


Figure 1

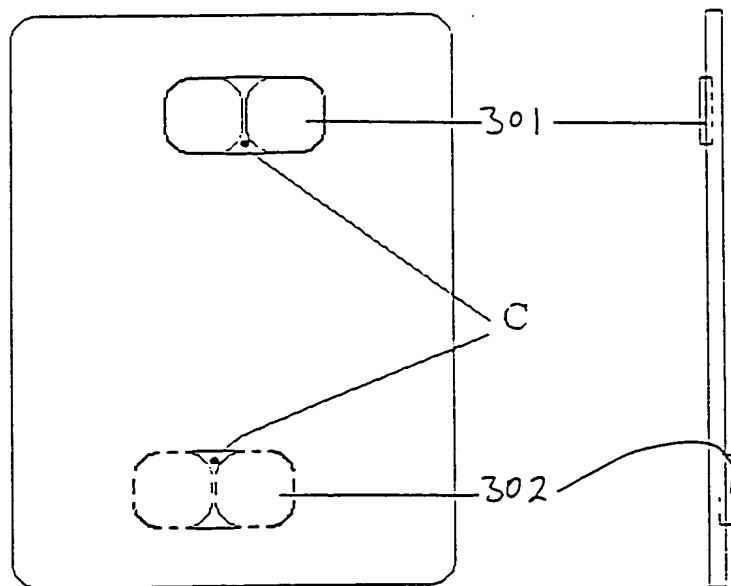


Figure 3a

Figure 3b

**THIS PAGE BLANK (USPTO)**

2/5

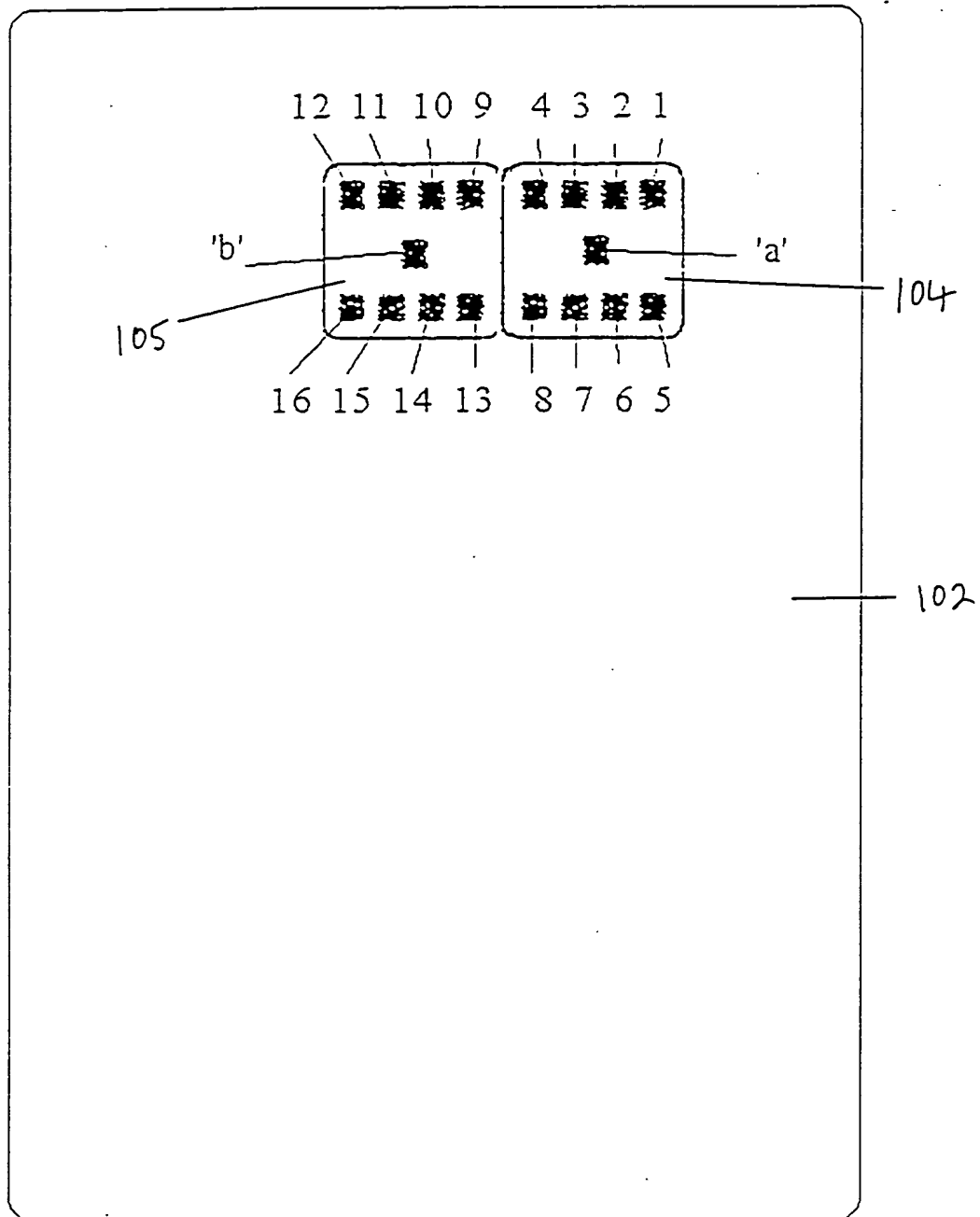


Figure 2

**THIS PAGE BLANK (USPTO)**

3/5

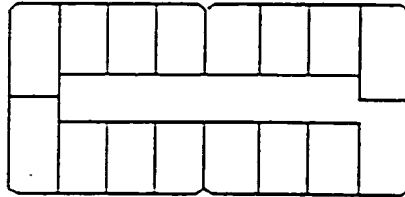


Figure 4

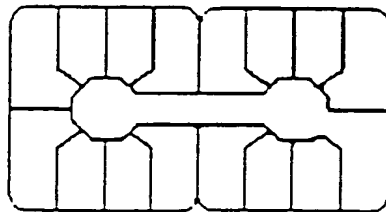


Figure 5

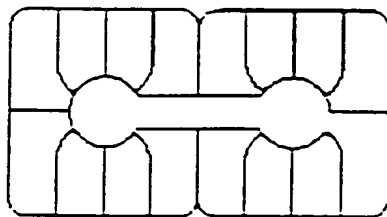
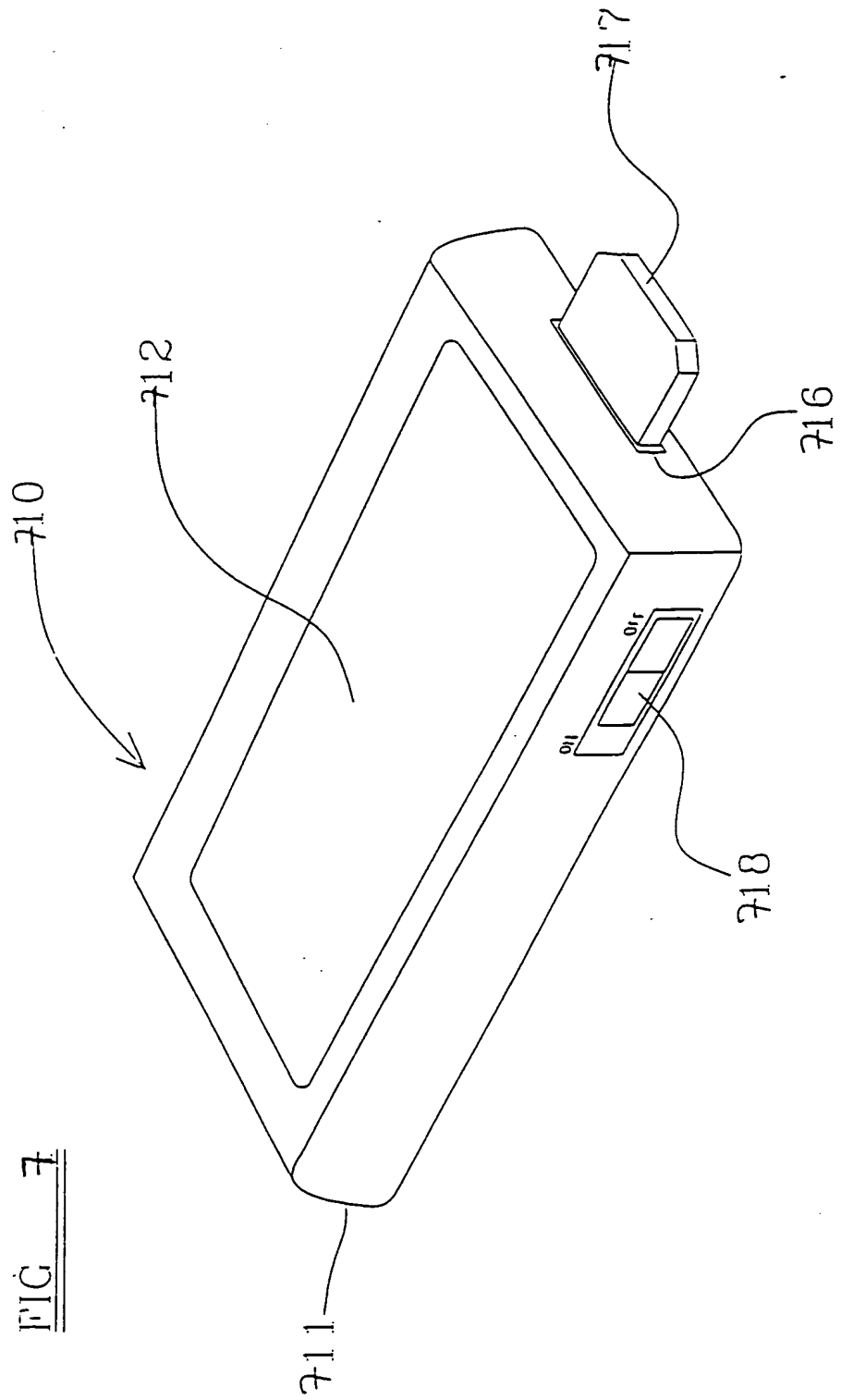


Figure 6

**THIS PAGE BLANK (USPTO)**

FIG 7



**THIS PAGE BLANK (USPTO)**

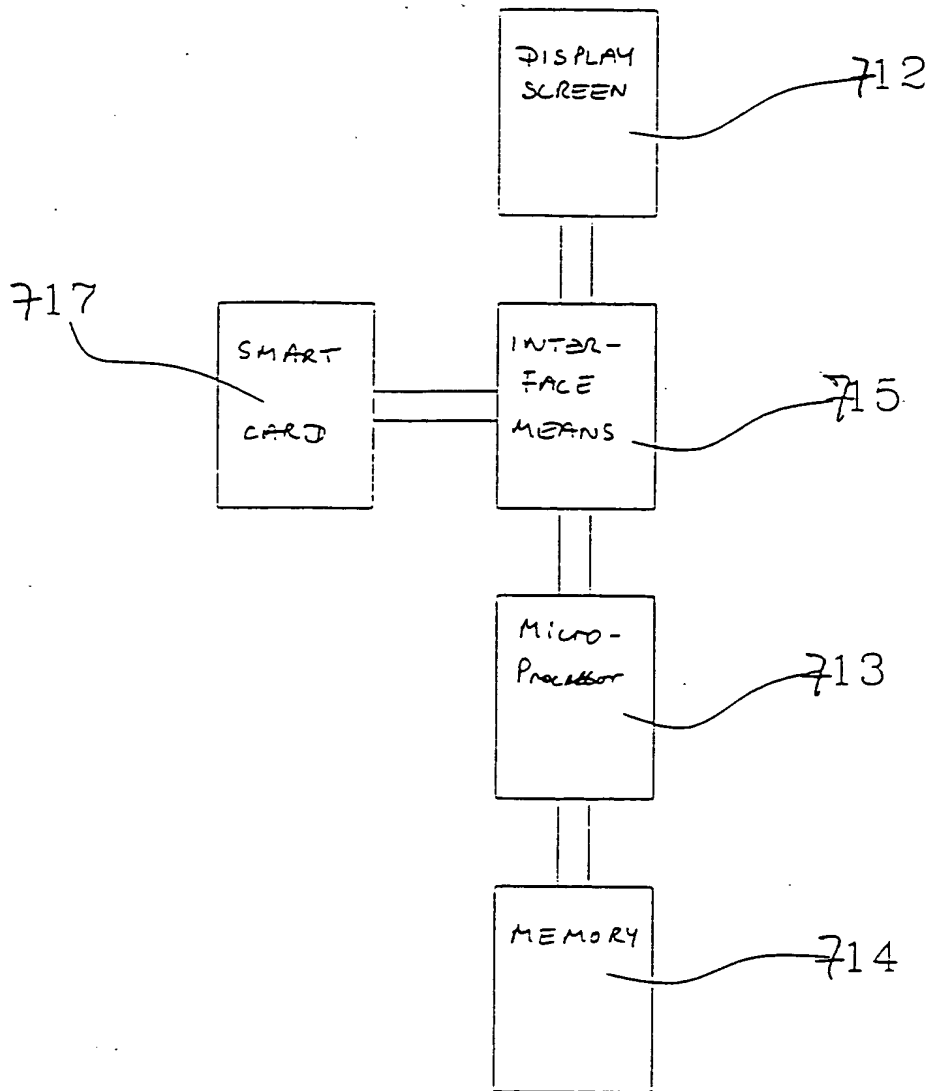


FIG 8

RT/SPACE - 25 Jan '00  
SOMMERVILLE + RUSHTON - 09/20922 3

THIS PAGE BLANK (USPTO)